MODERN BIOTECHNOLOGICAL REGULATIONS AS IT RELATES TO NIGERIA ECONOMY-LITERATURE REVIEW

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Abstract
This paper discusses the Modern Biological Regulations as relates to Nigeria Economy. Biotechnology is a branch of science that aims to improve living creatures by altering their biology. This is genetic engineering, which was discovered in the 1970s and is now widely used around the world because of its capacity to create new, altered organisms that have better genetic features than their parent or predecessor Deoxyribonucleic Acid (DNA). Medical and agricultural items are among the many things created via the application of biotechnology. There are a number of uses for Genetically Modified Organisms (GMOs).In our daily lives, biological technology has a wide range of uses. Cells and cell-derived compounds have been used in a variety of ways for decades, and this is no exception. It has a positive impact on many facets of human well-being. When it comes to diagnosis, biotechnology has changed the field and has the potential to be devastating if not used properly. GMO crops that are more resistant to pests and insects have led to an increase in agricultural productivity and a growth of the economy. Furthermore, in light of the industry's ethical and psychological repercussions and the resulting public unease, rules must be established to keep an eye on it.Though there are several technical issues of releasing GMOs in the environmental for commercial uses, safety of the laboratory workers, consumers and the environment as a whole is the biggest issue. The containment facility in the laboratories across the Asia-Pacific region often failed to live up to the term. Bio-safety and Biosecurity issues became much stricter after 2001, when anthrax attacks in the United States raised the spectra of bioterrorism using laboratory-prepared pathogens. Unfortunately, stringent biosafety and biosecurity rules are still impractical in many countries, where researchers often need to handle infectious agents such as anthrax and plague to protect public health, but lack the proper infrastructure.

Keywords: Modern Biotechnology, Production, Trade, Policy and Economy.

Introduction

The emergence of Modern Biotechnology and Genetically Modified Organism (GMOs), coupled with their perceived adverse impacts on the conservation and sustainable utilization of biodiversity

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and human health needed a bio-safety management system. The issue of Bio-safety Regulations in Africa is rapidly gaining Momentum as more Africa Countries are embracing GMOs. Republic of South Africa, Burkina Faso, Ghana and Egypt already have Bio-safety Laws and are currently growing and consuming genetically modified crops. Kenya, Togo, Benin Republic, Cameroon, Malawi, Uganda, Zambia, Tanzania and Mali also have Bio-safety Laws or guideline[1]. The African Union has developed a model Bio-safety Law to assist member States develop their Bio-safety Laws. However, to further strengthen bio-safety system in Africa, ECOWAS is currently developing a common bio-safety regulation in line with national bio-safety laws/regulations for the Sub-region. In the sub-region of West Africa, Nigeria is one of those Countries yearning for Common ECOWAS bio-safety regulation, which is being developed in the Africa region. Nigeria has also participated on bio-safety initiative and programs that promote regional bio-safety. Nigeria also signed and ratified the Cartagena Protocol on Bio-safety 2000 and ratified 2003 in commitment to global biodiversity management[2]. According to 2019 figures, Nigeria had Africa's largest economy with a GDP of approximately population of 203.5 million[3] people. 2.54 percent is the annual growth rate of the population. As the greatest oil producer in Africa, it's made the country a fortune over the past few years.[4] To put it another way: crude oil and gas exports account for almost 80% of the country's total earnings. The remaining 20% belongs to the country's Agriculture industry.[5]To promote and regulate biotechnology products (those products that are applicable to the prevention, treatment, or cure of a disease or condition of human beings and that are produced using living organisms, materials derived from living organisms, or cellular, subcellular, or molecular components of living organisms) Nigeria in recent years has created the National Biotechnology Development Agency (NABDA).[6] In recognition of the importance of biotechnology to national development, the Federal Executive Council on 6th of April 2001 approved the National Biotechnology Policy, which led to the establishment of the National Biotechnology Development Agency (NABDA) in November 2001 which was finally passed into law AS NABDA (Amendment) Act on 6th April 2022. The Agency was established under the aegis of the Federal Ministry of Science and Technology to implement the policy that is aimed at promoting, coordinating, and setting research and development priority in biotechnology for Nigeria. The biosafety bill was passed and signed into law, allowing the government to create the National Biosafety Management Agency (NBMA).[7]The National Biotechnology Development Agency (NABDA) is the Nigerian government agency responsible

[1] K. Redenbaugh, W. Hiati, B. Martineau, et al. (1992) *Safety Assessment of Genetically Engineered Fruits and Vegetables: A Case Study of the FLAVR SAVR Tomato*. Boca Raton, FL: CRC Press. 267

[3] Cartagena Protocol (n 13) art 19; see also: J Richter and others, Biotechnology for Crop Protection: It's Potential for Developing Countries (German Foundation for International Development (DSE 1998), see also. E. Mauriz, E.A Calle, A. Montoya, L.M Leechuga (2006) Determination of environmental organic pollutants with a portable optical immunosensor. Talanta 69:359-364.

[3] E. Oshionebo, 'Transnational Corporations, Civil Society Organizations and Social Accountability in Biotechnology.

[4] N. Ekweremadu, 'Opening Address,' delivered at the International Conference on Law Reform and Law-making Process in Nigeria, held in Abuja, Nigeria, on July 16, 2012.

[5] J. Andrew, 'FEC Approves NABDA Bill, to Transmit it to National Assembly,' This Day, October 30, 2014.

[6] K. Anderson and S. YAO, GMOs and World Trade: Implication for China as a WTO member, Contribution to International Conference on Greater China and the WTO, (City University of Hong Kong 2001).

[7] A.C Camero , P.K Trivedi, Micro-econometrics: Methods and Applications (Cambridge University Press, Cambridge 2005).

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for overseeing the use of biotechnology and regulating the sale of GMO products in Nigeria.[8] NBMA legislation ensures that all biotechnology products are certified and labeled for importation, as required by law.

As a part of its efforts to provide food security for its citizens, the Nigerian government has announced its intention to commercialize agricultural biotechnology. Her first GM crop, (Bacillus thuringiensis) cotton, which was commercialized in 2018,[9] has been given the go-ahead. Biotechnologically modified Cowpea were approved for commercial distribution. The method has also been used to develop other crops, such as Africa Bio-fortified Sorghum and salt-tolerant rice.[10] A requirement of the country's biosafety legislation is the requirement of product labeling for genetically engineered goods or substances with a proportion higher than four percent. [11]Civil society organizations and environmentalists have risen to oppose biotechnology, posing a significant obstacle to its commercialization. Increasing the farmers' positive attitude toward this contemporary technology will help Nigeria adopt the entire process of modern biotechnology in agriculture.[12]

Major Provisions of Laws as Relates to Biosafety and other Agencies in Nigeria

The need for strategies and products to protect public health and agriculture in the event of a natural emergency or man-made biological incident cannot be over emphasized. Nigeria is a heterogeneous entity in which its citizens must live in safety conditions and saved from harmful incidences through chemicals in biological research and non-laboratory organisms. [13]Nigeria as a country is endowed with a variety of plant and animal species, which consist of about 7,895 plant species, identified in 338 families; 2,215 genera; 22,000 vertebrates and invertebrates' species[14]. All of these animal and plant species that form Nigeria's biodiversity are in abundance within the country, highly cherished and therefore, need conservation and sustainable utilization[15].The emergence of Modern Biotechnology and Genetically Modified Organisms (GMOs), coupled with their perceived adverse impacts on the conservation and sustainable utilization of biodiversity and human health needed a biosafety management system. Therefore, Nigeria signed and ratified the Cartagena Protocol on Biosafety 2000 and ratified 2003 in commitment to Global Biodiversity Management[16].

[8] C. Falconi, Agricultural biotechnology research indicators and managerial considerations in four developing countries; In Cohen J.I., (ed.) Managing Agricultural Biotechnology – Addressing Research Programme Needs and Policy Implications, (London CAB International 1999).

[9] S. Cole and L. Rubin, Peer Review in the National Science Foundation, National Research Council. Washington, D.C.: National Academy Press 1978).

[10]H.D Leathers, P. Foster, The World Food Problem: Tackling the Causes of Under nutrition in the Third World (Lynne Rienner Publishers, Boulder 2004).

[11] D.T Plummer, An Introduction to Practical Biochemistry, 3rd Ed. London. (Mc GrawHill Book Company 1987)

[12] Magrath W.B., Factors Affecting the Location of the U.S. Biotechnology Industry. Agricultural Economics Staff Paper 85–26, (Cornell University, Ithaca, N.Y 1985).

[13] Aro v Lagos Island Local Government Council (2000) FWLR (Part. 13) 2132, and the more recent Nigerian Supreme Court decision in Mobil Producing (Nigeria) Unlimited v LASEPA, FEPA & Others ((2002) 18 NWLR (Part. 789) 1. 99.

[14] ibid 68

[15] O. Fagbohun, Mournful Remedies, Endless Conflicts and Inconsistencies in Nigeria's Quest for Environmental Governance: Rethinking the Legal Possibilities for Sustainability (2012) Nigerian Institute of Advance Legal Studies 66

[16] Ibid. 67

The development of a national biosafety regulatory framework for Nigeria dates back to 1994 when the first National Biosafety Guidelines were developed and the subsequent finalisation of a National Biosafety Management Act 2015[17]. The process of the development of the Act followed a systematic public involvement from 2002 to 2015.[18] Nagoya-Kuala Lumpur adopted the supplementary agreement to the Cartagena Protocol on Biosafety, the Supplementary Protocol aims to contribute to the conservation and sustainable use of biodiversity by providing international rules and procedures in the field of liability and redress relating to living modified organisms, as stated in its Article 1.[19] The Protocol applies to damage resulting from living modified organism which find their origin in a transboundary movement as contained Article 3 of the Protocol[20]. Manasmita M. (2015)**,** in an Article, Biosafety and Bioethics Issues in the Field of Biotechnology argued that the Protocol's major plank is to contribute to ensuring an adequate level of protection in the field of safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on conservation and sustainable use of biodiversity, taking into account risks to human **Article 23 of the Protocol** health and specifically focusing on trans-boundary movements[21]. Provide as follows:

> *"The Parties shall: (a) Promote and facilitate public awareness, education and participation concerning the safe transfer, handling and use of living modified organisms in relation to the conservation and sustainable use of biological diversity, taking also into account risks to human health. In doing so, the Parties shall cooperate, as appropriate, with other States and international bodies."*

The National Biosafety Management Agency Act, established the National Biosafety Management Agency (NBMA), was charged with the responsibility for providing regulatory framework, institutional and administrative mechanism for safety measures in the application of modern bio-technology and the use of genetically modified organisms (GMOs) in Nigeria[22]. The Act is in conformity with established national and International laws, procedures and rules that govern the safe adoption of the modern biotechnology practice and the safe use of GMOs globally. The NBMA Act is the only safety valve in the adoption of modern biotechnology and the deployment and use of GMOs for Nigeria's national economic development[23]. In view of the responsibility of the agency, knowledge based regulatory framework need to expand biosafety information through the media which will give room for factual reporting and build public confidence in adoption of safe GMOs and encourage scientist and others within the sector[24].

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[17] M.A Muzan, 'Some Insights on the legal Measures for Access and Benefit Sharing of Genetic Resources in Nigeria' (2017) 50 (1) VRÜ Verfassung und Recht in Übersee 49.

[18] Ibid. 50

[19] Article 1 and Article 3 of the Supplementary Protocol

[20] The Nagoya - Kuala Lumpur Supplementary Protocol on Liability and Redress was adopted on 15 October 2010 at the fifth meeting of the Conference of the Parties serving as the meeting of the Cartagena Protocol on Biosafety, held in Nagoya, Japan, and entered into force on 5 March 2018.

[21] UK House of Commons. Select Committee on Science and Technology, Session Report, genetically modified foods. 1999. HC286, Vol 1, http://www.fern.org/pmhp/dc/genetics/sci-tec.htm . Accessed August 2021.

[22] See Aro v Lagos Island Local Government Council (2000) FWLR (Part. 13) 2132, and the more recent Nigerian Supreme Court decision in Mobil Producing (Nigeria) Unlimited v LASEPA, FEPA & Others ((2002) 18 NWLR (Part. 789) 1

[23] Aro v Lagos Island Local Government Council (Supra)

[24] M.A Muzan (n 31) 275-298

The National Biosafety Management Act 2015 prescribes procedures for the application of the modern technology, risk assessment before the adoption and use of any genetically modified organisms and penalties for contravening the Biosafety Act[25]. The Biosafety Act is therefore a safety valve for harnessing the potentials of modern biotechnology safely. Ozor N, Igbokwe EM (2007), in an article- Roles of agricultural biotechnology in ensuring adequate food security in developing societies argued that the studies were unanimous in showing the fragile and incipient knowledge that researcher have about biosafety, especially when related to the precautionary measures used for each pathology and the actions after an accident with biological material.[26] Costa, (2010) in an article**,** Education of biosecurity: contribution of products formation- Studies affirm that education based mainly on the technical aspects of the theme is not effective in adding knowledge to undergraduates, and the contents should be structured in such a way as to stimulate the generation of competences, among them the formulation of problems, the formulation of solutions, the capacity to work in teams and technical capacity.[27]

Trade and Manufacturing Development of new products

For this purpose, the National Centre for Genetic Resources and Biotechnology (NACGRAB) was established in 1978, which was given the mandate to carry out scientific investigations and gather data and information related to genetic resources conservation as well as their use in biotechnology.[28] The Decree 33 of 1987 paved the way for the establishment of committees to regulate the seed, animal (domestic), and fishery industries. In the next few years, the country plans to introduce a new commercially available genetically altered crop:

B.t. Cowpeas

In collaboration with Australia, scientists have made significant contributions to the development of a drought-resistant variety of cowpea (the black-eyed pea). The Institute of Agriculture Research-Zaria (IAR-Zaria) conducted the research, which was completed and the crop was successfully grown. The National Biosafety Management Agency was presented with an application for deregulation and commercialization of Bt. Cowpea in October of 2018. (NABMA). The Nigerian government approved the commercial sale of Pod-Borer Resistant Cowpea in January 2019.

Bt. Cotton

The National Centre for Genetic Resources and Biotechnology registered two new cotton types on July 27th, 2018. (NACGRAB). MRC7377BGII and MRC 7361BGII are two of the two kinds of Bollgard II hybrid cotton that are now available.[29] The country's textile sector is expected to be transformed by the manufacture of these two types. The Institute of Agriculture's agronomic

[25] Ibid, 276.

[26] N. Ozor, E.M Igbokwe, Roles of agricultural biotechnology in ensuring adequate food security in developing societies. (2007) Afr. J. Biotechnology. 6(14): 1597-1602. Penn JB (2003). Agricultural biotechnology and the developing world. An Electronic Journal of the United States Department of State. Vol. 8, No. 3. Available at: www.usinfo.state.gov/journals/ites/0903/ijee/chassy.htm. Accessed Jan2018

[27] M.F.B Costa, Education of biosecurity: contribution of products formation, professional (2007) em saúde. Ciênc. Saúde Colet. 15 (1): 1741- 1750.

[28] M.A Muzan, Institutional Mechanisms for Biosafety in Nigeria: An Appraisal of the Legal Regime under the National Biosafety Management Agency Act, 2015. P. 234.

[29] A. Adesina, 'Score Card: Federal Ministry of Agriculture and Rural Development Mid-Term Report –January 1 – Dec 31, 2013.

performance experiment, which was required by the Biosafety Law on biotechnology, was conducted both on the station and in the farmer's fields. A seed firm in Nigeria, MAHYCO[30], has approved the commercialization of Bt. Cotton and provides farmers with access to biotechnology cotton seeds. In the first year, a thousand farmers will participate in the crop's rollout.

The Africa Bio-Fortified Sorghum

By altering these seeds, scientists hoped to create a new kind with higher levels of vitamins A, iron, and zinc. The Bill and Melinda Gates Foundation helped launch the development of Africa Bio-fortified Sorghum (BMGF).[31] The IAR-Zaria is still conducting research on this crop. The National Biotechnology Development Agency (NABDA) and the Agricultural Research Council of Nigeria are two of the organizations working together with Nigeria.

Salt-Tolerant Rice and Nitrogen and Water-Use.

Arcadia Bioscience and other partners, including USAID and the African Agricultural Technology Foundation, offer this technology.[32] The National Cereal Research was in charge of this research when it began in Nigeria in October of that year. The goal of this development initiative is to increase rice production in flooded, drought-stricken, and salty (saline) areas of the country.[33] To help small farmers in sub-Saharan Africa, this research aims to develop locally-adapted rice that is both nitrogen and water efficient as well as salt tolerant.[34] The development of a triple stacked variety using the most recent genes is being spearheaded and will be announced in the near future.

Testing New Cassava Varieties for Added Value

The GE-developed cassava cultivar is being studied in controlled field trials by the International Institute of Tropical Agriculture (IITA) and the ETH Plant Biosafety Lab (Switzerland).[35] In 2017, the National Biosafety Management approved the area for use.[36] To address the larger problem of post-harvest losses in Cassava in Africa, our research is focusing on the starch-rich root, which decomposes more quickly after harvest.

[30] E. Oshionebo, 'Transnational Corporations, Civil Society Organizations and Social Accountability in Biotechnology (Federal Ministry of Agriculture and Rural Development, January 14, 2014)

[31] N. Ekweremadu, 'Opening Address,' delivered at the International Conference on Law Reform and Law-making Process in Nigeria, held in Abuja, Nigeria, on July 16, 2012.

[32] Andrew J, 'FEC Approves NABDA Bill, to Transmit it to National Assembly,' This Day, October 30, 2014.

[33] O. Alawode,, 'Bio-safety Law Holds Many Possibilities for Nigeria Agribusiness,' Business Day, October 22, 2014.

[34] Anderson K. and YAO S., GMOs and World Trade: Implication for China as a WTO member, Contribution to International Conference on Greater China and the WTO, (City University of Hong Kong 2001).

[35] A.C Camero , Trivedi P.K., Micro-econometrics: Methods and Applications (Cambridge University Press, Cambridge 2005).

[36] S. Cole and L. Rubin., Peer Review in the National Science Foundation, National Research Council. Washington, D.C.: National Academy Press 1978).

Nigeria's plans for new projects

I. Drought-Tolerant Maize

Although Monsanto began working on this project several years ago, actual field trials have yet to begin.[37] The Biosafety Management Agency had already given the go light for the development of a Bt. Corn cultivar that is resistant to stacks of herbicides.[38]

II. Herbicide-Resistant Soybeans.

The National Biosafety Management Agency has previously granted the NABDA a field experiment permit to develop a kind of soybeans that are resistant to herbs.[39]

III. Cassava That Is Resistant To Viruses And Has Been Nutritionally Improved.

In collaboration with the Danforth Plant Science Centre, the National Root Crops Research Institute-Umudike (NRCRI) is working on a new initiative. Cassava Brown Streak Disease (CBSD),[40] which damages roots even when the rest of the plant is healthy, is the focus of this study, which aims to create a type of cassava that will be resistant to both diseases at the same time. CMD is a disease that can stunt or kill a plant in a short period of time. It is a disease that affects the cassava plant.

Production for the market

The commercial production of biotechnology crops, such as Bollgard II cotton, is continuing throughout the country. Commercial production of fiber, feed, and food is now awaiting official authorization.[41]

Imports

There is no ban on the importation of biotech crops into Nigeria. Most of the seeds used in research and animal feeds, such as grains for chicken production, are brought in from outside of the country. Prior to importation, a permit must be obtained from the NBMA and the application must be submitted to the appropriate authority at least 270 days before importation is to take place. Shipping that does not meet this requirement will be denied entry into Nigeria.[42] Nigeria has an open market for modern biotechnology-produced agricultural products. The assessment of risk is required by the Cartagena Protocol to evaluate the probability that particular hazards may occur to prevent harm and enable better risk management.[43]

Section 31(1) NBMA Act provides that

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[37] C. Falconi., Agricultural biotechnology research indicators and managerial considerations in four developing countries; In Cohen J.I., (ed.) Managing Agricultural Biotechnology – Addressing Research Programme Needs and Policy Implications, (London CAB International 1999).

[38] H.D Leathers, P. Foster, The World Food Problem: Tackling the Causes of Under nutrition in the Third World (Lynne Rienner Publishers, Boulder 2004).

[39] M.A Muzan, Institutional Mechanisms for Biosafety in Nigeria: An Appraisal of the Legal Regime under the National Biosafety Management Agency Act, 2015.

[40] W.B Magrath, Factors Affecting the Location of the U.S. Biotechnology Industry. Agricultural Economics Staff Paper 85–26, (Cornell University, Ithaca, N.Y 1985).

[41] D.T Plummer, An Introduction to Practical Biochemistry, 3rd Ed. London. (Mc GrawHill Book Company 1987).

[42] K.E Károly, The Founding Father of Biotechnology, February 2006, International Journal of Horticultural Science 12(1), DOI: 10.31421/IJHS/12/1/615

[43] Ogunba (n 47) 689.

"Every applicant seeking approval for any genetically modified organism under this Act shall, prior to the submission of the application, carry out a mandatory risk assessment of the potential risk the genetically modified organisms pose to human health, animal, plant or the environment in Nigeria"

The regulatory framework and policy

Genetic Engineering goods in Nigeria are regulated by the National Biosafety Management Agency. The National Biosafety Committee is responsible for reviewing applications and analysing data related to social-economic impacts of GE crops.[44] Before recommending any product to the Agency, the committee conducts a risk management review. Beintema N., Ayoola **G.B (2004),** in an article- Agricultural Science and Technology Indicators (ASTI): Nigeria- argued that nursing as a profession was created from scientific bases, according to the understandings of Florence Nightingale, in England, being directly influenced by experiences in places where lay nursing care was performed and based on religious concepts of charity and donation. Egbegba Rufus. (2018) in an article, Regulatory Role of National Biosafety Management Agency in the Safe Adoption Genetically Modified Organism- argued that since the beginning, nursing has suffered direct influences from religious teachings, but it is known that, behind the profession's fraternity and altruism, there are also, today, the scientific bases that consolidate the profession.[45]

Nigerian Institutions involved in Agricultural Biotechnology:
Federal Ministry of Environment Nigeria

Biosafety is a top priority for this ministry, thus it formed the National Biosafety Management Agency as the country's sole biosafety watchdog. In terms of modern biotechnology, it has its own regulating body.[46] GE crops or goods introduced into Nigeria will be regulated by the National Biosafety Management Agency, which provides the necessary Biosafety. A condition of the international treaty is that this Nigerian government ministry work along with the Secretariat of the Convention on Biological Diversity (Cartagena Protocol on Biosafety).[47]

Biosafety and Biotechnology Regulatory Agencies

The Biosafety and Biotechnology Regulatory Organization (BBRA) was founded as an autonomous agency that focuses on biosafety and biotechnology regulation. It is also responsible for the transportation of biotechnological goods, including exports and imports. Its responsibilities and roles are; create well-defined practice modules for modern biotechnology and make sure that the product they generate is safe for both human and environmental health.[48]

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[44] O. Phillip, Modern Biotechnology and Developing World Agriculture. University of Sussex; Brighton, United Kingdom; Institute of Development Studies [2001]. International Institute of Tropical Agriculture (IITA) and Technical Centre for Agricultural and Rural Cooperation (CTA) [1992] Biotechnology: Enhancing Research on Tropical crops in Africa. In: Thottapilly, Get al., (eds). Exeter, United Kingdom; Sayce publishing.

[45] R. Egbegba., Regulatory Role of National Biosafety Management Agency in the Safe Adoption of Genetically Modified Organism, Strategic Meeting held on 14 March [2018].

[46] D. Enejo., University-Corporate Relations in Science and Technology [1982] Paper presented at the National Conference on University-Corporate Relations in Science and Technology, University of Pennsylvania, Philadelphia, 15 December 1982.

[47] G. Steier, Advancing food integrity, GMO regulation, Agro ecology, and urban agriculture (2018) New York: CRC Press.

[48] M. Kruger, J.B.J Van Rensburg, J. Van den Berg, Transgenic BT maize: farmers' perceptions, refuge compliance and reports of stem borer resistance in South Africa, Journal of Applied Entomology (2001) 136 (1-2), 38-50

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The following are the roles and responsibilities;[49]

- to identify new challenges that need to be addressed by Nigerian authorities in the prudent use of modern biotechnology.
- It assures that modern biotechnology's goods and operations do not affect the environment or human health.
- Furthermore, it specifies in detail the roles and obligations of various organizations.
- In addition to removing genetically engineered creatures, modern biotechnology can also be regulated by the FDA. In order to analyse and manage risk, it establishes the abilities that are used.
- LMOs, food and processing are all covered by this regulation.
- it considers socioeconomic factors for risk management and product labeling of GE items.
- The removal of genetically engineered organisms is based on prior consent.

It is the responsibility of the Agency to provide all regulatory framework and methods to ensure that safety measures are used in modern biotechnology. One of its primary functions is to minimize the harmful effects on human health and the environment.[50]

The Federal Ministry of Agriculture and Rural Development in Nigeria.

Agriculture policy relating to contemporary biotechnology is the responsibility of this ministry, which implements policies and initiatives to assist agricultural activity. In addition, the ministry has a number of agricultural research organizations located around the country.[51]

Biotechnological Development Agency

In 2001, Nigeria's Ministry of Science and Technology formed this organization, which is responsible for drafting the country's biotechnology policy. Intended to promote and support biotechnology initiatives that involve indigenous and self-reliant institutions for the advancement of national growth, it has a mandate that raises concerns about the use of current biotech products.[52]

Food and Drug Administration and Inspection Service (NAFDAC)

It is tasked with determining the maximum amount of herbicide residue that can be found in food and feed produced by biotech processes. In addition to food safety, it is responsible for medication and chemical safety as well.[53]

[49] Aro v Lagos Island Local Government Council (2000) FWLR (Part. 13) 2132, and the more recent Nigerian Supreme Court decision in Mobil Producing (Nigeria) Unlimited v LASEPA, FEPA & Others ((2002) 18 NWLR (Part. 789) 1. 99.

[50] ibid 68

[51] O. Agbohun., Mournful Remedies, Endless Conflicts and Inconsistencies in Nigeria's Quest for Environmental Governance: Rethinking the Legal Possibilities for Sustainability (2012) Nigerian Institute of Advance Legal Studies 66

[52] Ibid. 67

[53] The Economics of Intellectual Property Rights Under Imperfect Enforcement: Developing Countries, Biotechnology, and the TRIPS Agreement, by Konstantinos Giannakas, September 2001

Science and Technology Complex Sheda (SHESTCO)

The Nigerian government owns and operates this biotechnology research and training facility. In the areas of health, agriculture, and the environment, it explores and explains how biotechnology can be applied domestically.[54]

The Nigerian National Universities.

Biotechnological research is a major focus of many National Universities, with many doing confined field trials that are largely counted by the biosafety committees.[55]

The Biosafety Committee of the United States (NBC)

Nigeria's biosafety agency is a well-respected government agency. A biotechnological activity's safety is NBC's responsibility. There are 16 members on the committee, and they come from a wide range of institutions, both public and private. National Biosafety Technical Subcommittees (NBTS) were established by this committee to focus on various assigned areas, such as agriculture, health and industry. As an advisor to the National Biosafety Committee, NBTS helps to promote field trials and market placement through their various activities.[56]

Approvals

Regulations for food and feed processing can differ from one environment and another. Currently Nigeria is the only country in Africa where Bt. Cotton has been certified for environmental release. This also contains imported GE corn and a soybean type that has been certified for use in Nigeria. Food and oil processing can be done with these crops. It has been approved by the National Biosafety Committee for use and safety. About 180 days are required for a product to be approved.[57]

Field trials

Field testing and evaluations are permitted, and approval is only contingent upon the National Biosafety Guidelines. Included in this legislation is a need for field testing of bio-engineered crops. With the help of other organizations like IAR-Zaria, the Nigerian cowpea and cassava are being promoted to a broader audience. The Biosafety Systems initiative has assisted in regulatory compliance, which has enabled capacity building and the provision of guidance.[58]

The Role of Labels and Traceability

Under the biosafety regulations, any product that contains more than 4% GE must be labeled as such. "genetically modified organisms," or GMOs, are products that have been proven to contain

[54] C. James, Global Status of Commercialized Biotech/GM Crops: [2012], ISAAA Briefs No.44 (International Service for the Acquisition of Agri-biotech Applications, Ithaca, NY).

[55] J.B Penn, Agricultural biotechnology and the developing world. An Electronic Journal of the United States Department of State. Vol. 8, No. 3 (2003). Available at: www.usinfo.state.gov/journals/ites/0903/ijee/chassy.htm Accessed February 2021.

[56] A. Pollack , F.D.A Faults Companies on Unapproved Genetic Tests, The N.Y Times NewYork, http://www.nytimes.com/2010/06/12=fda%20genetic%20test&st=cse accessed April, 2022)

[57] A.H Zakiri, Sustainable development and agricultural biotechnology in prospect for food security and agricultural sustainability in developing regions: New roles of international collaborative research (2002). The 10th JIRCAS International Symposium, pp. 141-146.

[58] Op.cit, O. Coker., 1987.

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GMOs.[59] To ensure that consumers are informed of what they are purchasing, this labeling preserves their right to know. To comply with NAFDAC's standards, food labels must be informative and easily accessible to the consumer.[60]

Testing and Monitoring

The National Biosafety Management Act mandates this regulation. The consequences for noncompliance with biosafety requirements have been established by legislation.

MARKETING

i. **The views of the general public and private individuals**

The GE food products are seen differently by Nigerians. Some argue that it is critical to the country's food security, while others are concerned about the potential health and safety risks that may arise from consuming this product. This reveals that there is a lack of understanding about what biotechnology is and what it can do for the world. Many Nigerians, however, believe that the time has come to domesticate the technology and help various research institutions in their efforts to develop genetically engineered crops (GE) in Nigeria.[61]

ii**. Acceptance in the market**

Bt. Cotton, for example, has proven to be of more benefit for Nigerian farmers because of its ability to increase yields while lowering costs, and they are willing to embrace the technology in the market. Research institutes and the public have a good relationship.[62]The court in the case of **Homef & 16 Ors V Nbma & 5 Ors[63]**

The question in this suit is whether the permits for Genetically Modified (GM) cotton and maize supplied by Monsanto and approved in 2016 by NBMA for commercial release and confined field trial respectively defy the fundamental rights to life and human dignity of Nigerians? The suit against NBMA, NABDA, Monsanto Agricultural Nigeria Limited and others with regards to permits for introduction of Genetically Modified Organisms (GMOs) into Nigeria plods on. The hearing of the case which was earlier scheduled for 20 January 2021 was adjourned to 23 March 2021. The case was mentioned at the Federal High Court, Abuja, with both parties present and ready for hearing but the court excused the proceeding for lack of time. Bassey stated that the adjournment will not deter efforts to ensure that justice prevails and to secure our food system from the hazards of modern agricultural biotechnology. "The case is very much alive" the statement reads.

The case seeks a declaration that the BT cotton (MON 15985) and maize (1) NK603 & (2) MON89Q34 x NK603 supplied by Monsanto and approved by the NBMA for commercial release and confined field trial respectively in Nigeria contravene the fundamental rights to life and human dignity of Nigerians. These rights are guaranteed under **Section 33 and 34 of the 1999**

[59] H.E Bouis., The effect of income on demand for food in poor countries: are our food consumption databases giving us reliable estimates? [1994] Journal of Development Economics 44: 199–226.

[60] A. Janvry, E. Sadoulet, World poverty and the role of agricultural technology: direct and indirect effects [2002]. Journal of Development Studies 38(4):26

[61] Ibid. 38(4):26

[62] Op.cit, A.H Zakiri, 2002.

[63] FHC/ABJ/C5/846/2017

Constitution (As Amended) and **Article 4, 5, 16 and 24 of the African Charter on Human and Peoples' Rights (Ratification and Enforcement) Act.**

Also, the case seeks a declaration that the continuous refusal by NBMA and Monsanto to provide scientific evidence to dispel fears of the applicants as contained in the Exhibits presented in court infringes on the fundamental rights of the applicants as guaranteed under the Nigerian Constitution and aforementioned Act. The case was first filed in the Federal High Court of Justice, Abuja in 2017 but was struck out on 15 August 2018, not for lack of merit or cause of action but for technical reasons. The case was, however, resumed in 2018 as a matter of fundamental human rights and has been scheduled for hearing at the Federal High Court of Nigeria on 23 March 2021 after several shifts on hearing dates. "GMOs have been linked by various studies to serious environmental and health maladies. This has grave implication for biological diversity which enhances resilience to climate change and pandemics such as the COVID-19. This threatens our indigenous and nutritious foods and promote unsustainable agricultural practices. Nigeria has not conducted long term tests to disprove these threats. And we have no confidence in the NBMA as regards protection of the interests of farmers and consumers."

The claim of safety of GMOs is questionable in that information about applications, field trial results and risk assessment documents are not made accessible to the general public. Furthermore, it was asserted that it is not the job of NBMA to promote GMOs or promote economic development. This demonstrates the conflict of interest which is also evident in the composition of NBMA board as a major biotechnology promoter (National Biotechnology Development Agency) sits on the board of the regulatory Agency. Health of Mother Earth Foundation (HOMEF) calls for a ban on GMOs in Nigeria, stressing that the way to food security and food sovereignty in Nigeria is through Agro-ecology and adequate support for small holder farmers.

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Monsanto Tribunal: Judges to Deliver Legal Advisory Opinion

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[64] HOMEF & 16 ORS v NBMA & 5 ORS FHC/ABJ/C5/846/2017

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job of NBMA to promote GMOs or their so-called importance for economic development. This demonstrates the conflict of interest which is also evident in the composition of NBMA board as a major biotechnology promoter (National Biotechnology Development Agency) sits on the board of the regulatory Agency. HOMEF thus called for a ban on GMOs in Nigeria, stressing that the way to food security and food sovereignty in Nigeria is through Agroecology and adequate support for small holder farmers.

A network of science communicators has called on stakeholders to come together and ensure more public education on the use of genetically modified organisms (GMOs) in Nigeria. Making the call under the auspices of Journalists for Social Development Initiative (JSDI), a non-governmental organisation focused on the promotion of awareness around sustainable development, the group stated that criticisms in respect of the operations of biosafety regulations, as well as safe modern biotechnology practices particularly its application in agriculture, clearly reveal the urgent need for authoritative information platform to help build the right public knowledge and trust required to foster the acceptance of this technology in the country. The group, during an event organised in collaboration with Embassy of the Republic of Ecuador with the theme: "From Monologue to Stakeholder Engagement – building trust through science-based reporting" held recently in Abuja, observed that various studies and stakeholder engagements attributed this crisis on poor public understanding and potentials of biotechnology in transforming economy and ensuring sustainable growth.

Stakeholders now must face the ambitious task of fostering constructive public dialogue and policy that employs biotechnology as a tool to solve these problems. The government of the Republic of Ecuador strongly believes in science and would support any initiative that is technology-driven to foster sustainable development by initiating a public education campaign and pledged the support of government to help fulfil their goal. The inauguration of Biosafety & Biotechnology Communications Committee (BBCC) has been espoused to make a work plan to champion public enlightenment on the adoption of biotechnology across the country.

Conclusion

With regard to biotechnology regulation in Nigeria's economy, the country appears to be making more effort to ensure that they are in full compliance. Biotechnology is becoming increasingly accessible to the general public thanks to increased public awareness. In addition, it is encouraging to see several private sector companies in Nigeria selling Bt. Cotton and Nigerian Soybeans. The Ministry of Agriculture in that country is well-equipped to enable the current biotechnology process. Bt. Cotton is an example of a biotech crop that has several advantages in Nigeria, and the majority of the country's population have realized this. The remainder of the population should be made aware of the issue in the same way. From a perusal of the Act through this study, it can be deduced that Nigeria is quite receptive to the introduction of GMOs, provided that all conditions precedent stipulated under the Act are complied with. Although this research has not examined GMOs in the light bordering on international economic, environmental and health issues, it has provided a pathway to comprehending the purport, adequacy or otherwise of the National Biosafety Management Agency Act 2015 as amended. However, the implementation of the provisions in the Act has to be cautiously and efficiently carried out so as not to enhance the replacement of traditional agriculture and traditional varieties of staple crops through the use of

genetically engineered crop varieties which exterminates seeds in the second generation leading to farmers having to purchase seeds for planting every year. This may eventually lead to loss of agricultural heritage as regards traditional systems of seed supply, soil fertilization and pest control. The purpose of the Act is to set up an institutional framework to regulate the activities involving biotechnology within Nigeria, without losing sight of the health and environmental risks associated with such activities. It is hereby recommended that Nigeria should adopt the use of a more general and elaborate term such as PNTs to describe products of biotechnology rather than focusing on just one process of biotechnology used which is GMO. This approach will be in line with the title of the Act and accommodate emerging developments in biotechnology. Also, this will prevent a situation where there would be a constant need for enacting (new laws) or amending our laws to reflect the emerging trends in the constantly evolving field of biotechnology. It is recommended that a provision mandating the periodic publication of a gazette showing approved GMOs should be incorporated into the Act either by the way of amendment or through subsidiary legislations as provided for under section 41 of the Act to promote public awareness. From a perusal of the Act through this article, it can be deduced that Nigeria is quite receptive to the introduction of GMOs, provided that all conditions precedent stipulated under the Act are complied with. Although this article has not examined GMOs in the light bordering on international economic, environmental and health issues, it has provided a pathway to comprehending the purport, adequacy or otherwise of the National Biosafety Management Agency Act 2019. However, the implementation of the provisions in the Act has to be cautiously and efficiently carried out so as not to enhance the replacement of traditional agriculture and traditional varieties of staple crops through the use of genetically engineered crop varieties which exterminates seeds in the second generation leading to farmers having to purchase seeds for planting every year. This may eventually lead to loss of agricultural heritage as regards traditional systems of seed supply, soil fertilization and pest control.

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